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Sent: 1/15/2016 6:23:36 PM
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Subject: Fw: flint update --> "Legionnaire's Disease Possibly Associated With Flint River Water Supply"

fyi

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Sent: Friday, January 15, 2016 10:31 AM
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Subject: flint update --> "Legionnaire's Disease Possibly Associated With Flint River Water Supply"

Hi All,

New link on Flint Water Study website → http://flintwaterstudy.org/2016/01/legionnaires-disease-possibly-associated-with-flint-river-water-supply/

Legionnaire's Disease Possibly Associated With Flint River Water Supply

flintwaterstudy.org

Media Inquiries: Dr. Amy Pruden (apruden@vt.edu; 540-231-3980) Dr. Otto Schwake (ottos@vt.edu) 1) Outbreak interpretation: incidence and case-fatality rate Recently a public announcement was made that a surge in Legionnaires' disease occurred in Genesee County in 2014 and 2015. Here we provide a summary of the results shared by the county and state health departments, with...

"Legionnaire's Disease Possibly Associated With Flint River Water Supply

January 15, 2016 Siddhartha Roy Articles, Research Updates

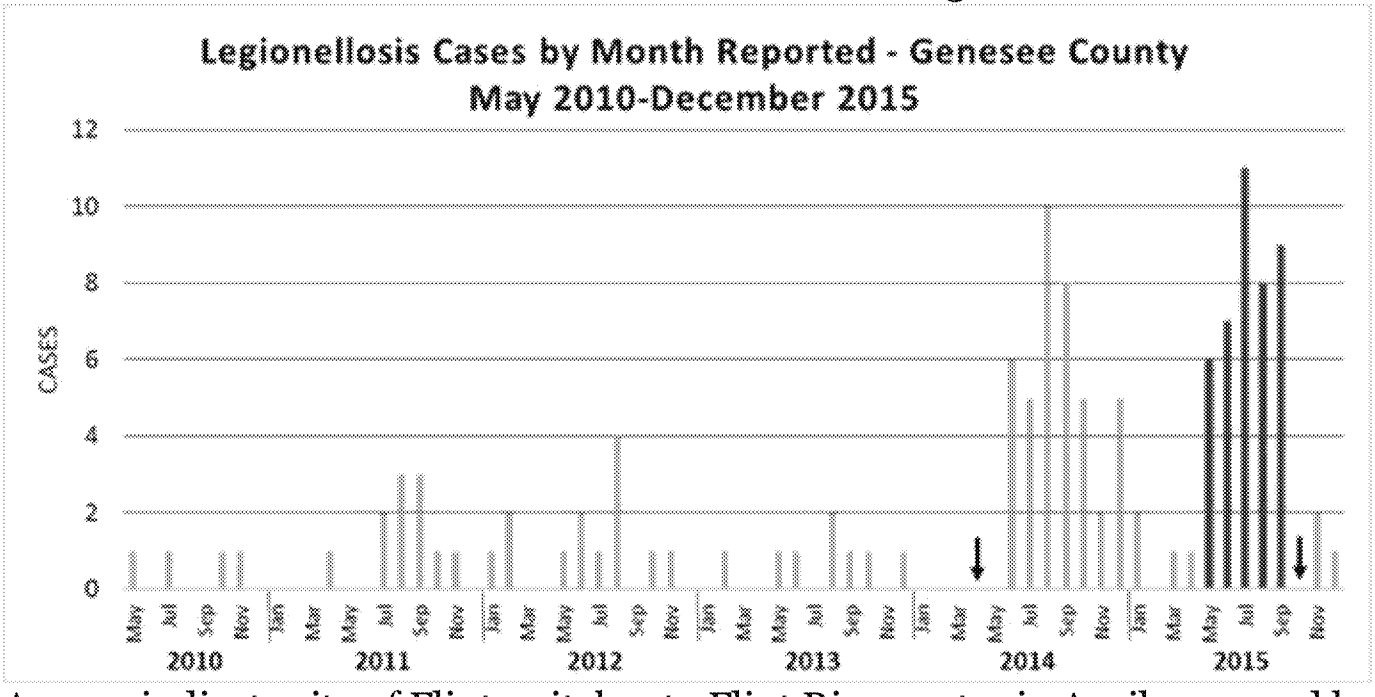
Media Inquiries: Dr. Amy Pruden (apruden@vt.edu; 540-231-3980) Dr. Otto Schwake (ottos@vt.edu)

1) Outbreak interpretation: incidence and case-fatality rate

Recently a public announcement was made that a surge in Legionnaires' disease occurred in Genesee County in 2014 and 2015. Here we provide a summary of the results shared by the county and state health departments, with context to help Flintwaterstudy readers to better understand the situation. Please also see our Frequently Asked Questions on Showering and also our short explanation of hypothesized links between Legionnaires Disease and Lack of Corrosion Control.

Genesee County Public Health Data

An increase of Legionnaires' cases in fall 2014 prompted a public health investigation, revealing 45 confirmed cases, with 7 deaths, from June 2014 through March 2015.[1] While the formal investigation for a second spike in cases for summer 2015 is underway, current data show 44 cases from April through December, with 3 deaths. We've constructed a complete timeline showing these cases, along with those from the previous four years. **We note that our public health report collection is incomplete, leading to an approximation of the number of cases for certain months in 2015.**



Arrows indicate city of Flint switches to Flint River water in April 2014 and back to Lake Huron water in October 2015. Red bars correspond to a second cluster of cases in summer 2015. Note that monthly case values are approximated for May/June 2015 and August/September 2015.

These clusters of cases can be considered **outbreaks**, as defined by multiple cases of a disease in one location during a similar time frame. Any disease outbreak is a public health issue, but two occurring within a year span in the same area is a concern, even more so when a large number of cases are involved. For comparison, the major outbreak occurring during late summer 2015 in the Bronx had 128 confirmed cases with 12 deaths.[2]

While the total numbers of cases and deaths were larger for the highly publicized New York outbreak, the picture changes when taking into account disease

incidence. Typically measured in cases per 100,000 people, incidence is an important metric when examining disease. With a population of 1.4 million, the New York City borough of the Bronx has several times the population of Genesee County, which is home to 415,000, and the City of Flint, at 100,000. When factoring in population, the Bronx outbreak had an incidence of 8.9 cases/100,000 population, while the 2014 Genesee County outbreak came in at 10.8 cases/100,000 population. This figure becomes even larger when taking into account the proportion of confirmed cases diagnosed within the city of Flint itself. Incidence-wise, 2015 was high as Genesee County experienced a yearly rate nearly 9 times the national average of 1.36 cases/100,000 population.[3]

Case-fatality rate, the deaths from a disease among a given number of cases is another way to assess the impact of an outbreak. With an average fatality rate of 9%,[3] similar to most forms of pneumonia, Legionnaires' is relatively lethal when compared to other waterborne diseases. With 7 confirmed deaths from 45 total cases, the 15.5% rate for the 2014 Genesee County outbreak was 1.5 times greater than the 10% rate reported for the Bronx outbreak. While the sheer number of cases is concerning, the increased case-fatality rate of the 2014 Genesee County outbreak highlights its severity, particularly so given the substantially smaller population cluster of Flint. When examining this rate, along with the incidence for Legionnaires' in the county, we get a good picture of just how serious the two outbreaks really were.

Legionnaires' Disease Transmission

People typically contract Legionnaires' disease by **inhaling** bioaerosols (i.e, tiny drops of water suspended in air) containing the bacteria *Legionella*. **Aspirating** while drinking (i.e., drinking water not going completely into your stomach but instead going into your lungs) is another transmission route for the disease. Legionnaires' is not contagious and a victim cannot infect another person.[4]

Regardless of how the disease is transmitted, a contaminated substance in the environment, usually water, is the source. When water pipes are damaged, they becomes a more attractive environment for certain pathogenic bacteria, including *Legionella*, to establish and grow. For example, **corrosion** damage (such as what occurred in Flint) can lead to main breaks and the leaching of nutrients like iron for the bacteria. We have demonstrated this in laboratory research, ***in a recent series of experiments funded by the National Science Foundation and the Alfred P. Sloan Foundation.***[5] With this in mind, in July, 2015, our group wrote a grant proposal to the NSF in which we predicted that the corrosive damage to Flint's drinking water distribution system would be expected to increase levels of *L. pneumophila*, and potentially other pathogens that grow in building plumbing systems. Recently released public health data and our own environmental testing in large buildings of Flint support our hypothesis. **This leads to the question on many peoples' minds: were the Genesee County outbreaks caused by the poor quality water in the City of Flint**

when the Flint River was used as the drinking water source? The short answer is this: due to limited data it cannot be said for certain. Without turning back time to collect and analyze bacteria from patients and the water, it is difficult to make a scientifically conclusive argument demonstrating a source of transmission. However, the fact that the number of Legionnaires' disease cases increased so dramatically during the period that Flint River water was being used is impossible to ignore (see Figure above). Forty two and Forty five cases occurred in Genesee County during 2014 and 2015, with ten total deaths, while the previous 4 years saw only 4-13 cases.

During a follow-up investigation in response to the 2014 outbreak[1], the county and state attempted to pinpoint a **common source of transmission**. After examining the numbers of patients who presumably became ill within Flint hospitals and those who received corrosive Flint water at home, a common source could not be definitively identified, in part due to a lack of bacterial isolates from patients for comparison to those in the environment. That being said, of the 35 patients for which the report detailed household water source information, 60% received Flint water at home. In addition, 44% of patients without a presumed health-care transmission route were on Flint water, which is a disproportionate number considering the city makes up less than a quarter of the county's population. These figures, combined with the fact that nearly half of surveyed patients' homes were impacted by a main break, seem to suggest a very strong likelihood that the corrosion problem with Flint River water (and associated low chlorine residuals) played a role in the surge in Legionnaire's disease.

Identifying the Problem

Legionnaire's disease is difficult to investigate and challenging to control, in part due to *Legionella* being an **environmental pathogen**; we contract them from sources around us (like water) instead of from each other. This causes a major difficulty in that the number of entities and professional fields involved in Legionnaires' prevention and outbreak response. For example, drinking water is treated by engineers at treatment plants, then delivered to building plumbing designed by architects and worked on by plumbers. After a person contracts the disease, they are diagnosed by a medical doctor, who reports the case to epidemiologists and microbiologists that try to pinpoint the source of transmission. Meanwhile, university researchers are busy performing experiments to help provide each of these groups with information needed for them to do their jobs. Reducing the risk for Legionnaires' and responding to cases demands that everyone involved work together, which is not always easy to do. When it comes to controlling *Legionella*, the exact factors that trigger its growth and propensity to cause outbreaks in drinking water are also poorly understood, resulting in no silver bullet fixes. For sure, disinfectants such as chlorine are VERY important, but because chlorine decay is enhanced by corrosion[5] (i.e.,

Flint River water) it is especially hard to maintain high enough levels to kill *Legionella* in building plumbing impacted by corrosion. For example, we never detected chlorine at Lee-Anne Walters' house. To make matters worse, Legionnaires' disease cases can be tricky to identify and assess. Even though it is a federal requirement to report cases to the state health department,[6] the disease can be confused with other forms of pneumonia. This and other factors cause it to be highly **under-reported** in that for every confirmed case, many more aren't accounted for. This is even before considering the fact that the responsible pathogen isn't identified in up to 50% of pneumonia diagnoses[7] and that Pontiac Fever, another form of infection caused by *Legionella*, is hardly reported because the illness is less severe and hard to differentiate from the flu. Furthermore, the urine antigen test used for 90% of Legionnaire's disease diagnoses is not 100% accurate and only detects one out of the multiple pathogenic strains of Legionella bacteria.[3] This diagnostic tool also doesn't provide valuable information for tracking down sources of infection that more laborious and difficult culturing methods will.

It's also important to keep in mind that for the types of diseases caused by bacteria that live in plumbing systems, Legionnaires' is the only one that requires federal documentation and reporting. This means that if there were other waterborne diseases such as non-tuberculosis mycobacterial (NTM) infection that were occurring in Flint due to problems with the corrosion control, it would be difficult to draw an association with the city's drinking water; thus, the microbial issues may have been worse than we know. To help address this and future *Legionella* concerns, education of water professionals, medical professionals, and citizens is key.

In line with this, we have some **recommendations** for the residents of Flint and elsewhere in the United States:

First, those concerned should familiarize themselves with the symptoms of these illnesses, which are conveniently available at www.cdc.gov.

Second, those with major risk factors (the greatest of which being smoking, age >50, diabetes, and recent surgery) should be aware in order to limit exposure to potentially contaminated sources.

Finally, with the high use of home water filters in Flint, it is vital that residents understand how to correctly operate and maintain these devices, as our research has shown that improper usage may increase risk for pathogen transmission.[8]

Finally, Legionnaires' disease was first discovered in 1976, though it was not strongly accepted that drinking water was a significant cause until about 1998 and there are currently no Federal laws specifically designed to control it in municipal drinking water.[9] We now suspect that failure to follow other regulations can exacerbate *Legionella* issues; for example, the corrosion control law that was not followed in Flint, would have helped to control Legionella growth in the in the city water

supply. The key point is that, unlike the much better understood situation with lead corrosion, knowledge about Legionannaire's disease is still rapidly evolving. We also note that world class scientists from EPA and consulting companies have been working on this very issue in Flint, and are actively helping to address these concerns.

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Thanks,
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